

ProLiant BL p-Class networking overview

Technology brief



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Abstract

This technology brief describes how Ethernet network signals are routed through the ProLiant BL p-Class system components. It provides an overview of the patch panel and Ethernet switch interconnect options for connecting the network signals to the external network infrastructure.

The intended audience for this paper includes engineers and system administrators familiar with the HP ProLiant BL p-Class system. For readers not familiar with the HP ProLiant BL p-Class system, more information is available at <http://h18004.www1.hp.com/products/servers/platforms/index-bl.html>.

Introduction

Each HP ProLiant BL p-Class server blade contains multiple embedded network interface controllers (NICs)¹. The p-Class system includes a server blade enclosure that contains a signal backplane for routing of Ethernet signals from the server blade NICs to the interconnects in a redundant, highly available architecture. HP offers six interconnect options for a choice of how the Ethernet Fibre Channel² signals exit the server blade enclosure. Available interconnects include four Ethernet switch options for network cable consolidation and two patch panel options for signal pass-through to third-party devices.

This white paper:

- Identifies the NICs available with each ProLiant BL p-Class server blade.
- Describes how the Ethernet network signals are routed through the p-Class server blade enclosure.
- Provides a decision chart to help customers choose the appropriate interconnect option.
- Provides an overview of each interconnect option.

For more information about the interconnect switch options, see the *ProLiant BL p-Class GbE Interconnect Overview* white paper³ and the *ProLiant BL p-Class GbE2 Interconnect Switch Overview* white paper⁴.

ProLiant BL p-Class server NICs

The ProLiant BL p-Class servers include multiple, general-purpose ProLiant NC series NICs and one additional NIC dedicated to Remote Insight Lights-Out Management (iLO) Advanced. Table 1 identifies the type and number of embedded NICs available with each ProLiant BL p-Class server blade.

Table 1. NICs embedded in ProLiant BL p-Class server blades

ProLiant BL p-Class server blade	NC7781 10/100/1000	iLO 10/100	Total NICs
BL20p G2	3	1	4
BL30p	2	1	3
BL40p	5	1	6

¹ An embedded NIC integrates the Ethernet capabilities directly onto the system board to eliminate using an I/O slot for Ethernet connectivity.

² For information on the Fibre Channel signal routing and available options, see the *ProLiant BL p-Class SAN Storage Connectivity* white paper at <http://h200001.www2.hp.com/bc/docs/support/SupportManual/c00220357/c00220357.pdf>.

³ Available at http://wws1pro.compaq.com/support/reference_library/viewdocument.asp?source=5982-2729EN.xml&dt=21.

⁴ Available at http://wws1pro.compaq.com/support/reference_library/viewdocument.asp?source=5982-2175EN.xml&dt=21.

Each ProLiant NC series NIC has been designed, developed, and manufactured to meet the needs of ProLiant customers. HP's testing, certification, and validation of the NICs within ProLiant servers further enhance this value. The NC series NICs provide the following features:

- Preboot eXecution Environment (PXE) and Wake on LAN (WOL) capability
- High-availability teaming including Network Fault Tolerance (NFT), Transmit Load Balancing (TLB), and Switch-assisted Load Balancing (SLB)
- Teaming Configuration GUI for Microsoft operating systems
- Auto-negotiation for speed and duplex communication
- Support for management agents and sophisticated management tools such as HP Systems Insight Manager
- TCP Checksum and segmentation offload to reduce the load on the CPU for improved overall system response (NC7780 and NC7781)

For additional information, see the ProLiant NC series network adapter home page at <http://h18004.www1.hp.com/products/servers/networking/index.html>.

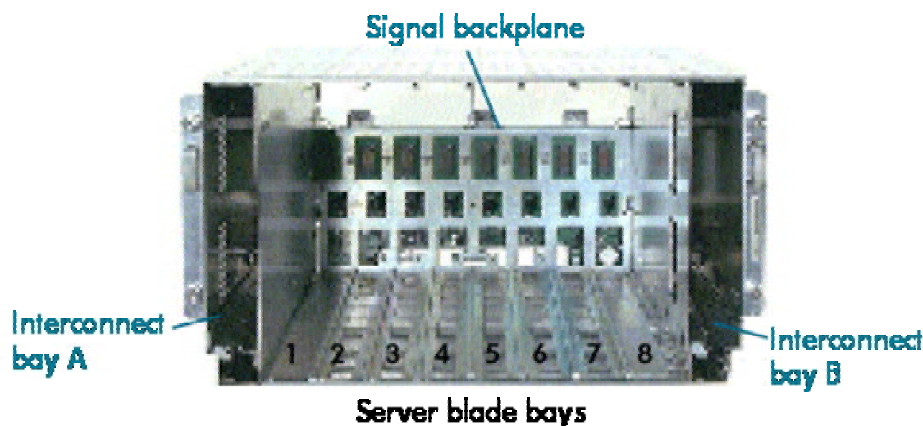
ProLiant BL p-Class server blade enclosure

The ProLiant BL p-Class server blade enclosure is a 6U (10.5-inch) chassis with two outside interconnect bays and eight interior server bays (Figure 1). Two enclosure options are available:

- The original or non-dedicated iLO enclosure supporting up to eight ProLiant BL20p servers or two ProLiant BL40p servers.
- The updated or dedicated iLO enclosure supporting up to 8 ProLiant BL20p servers, 2 ProLiant BL40p servers, or 16 half-height ProLiant BL30p servers.

Both enclosure options support combinations of different series server blades. The server blades and the interconnect blades slide into the bays and blind mate to the enclosure backplane for power and data connections. From an Ethernet signal standpoint, the two enclosures differ in the way in which they route the signals from the iLO NICs. For more information, see the section titled "Blade enclosure network signal routing".

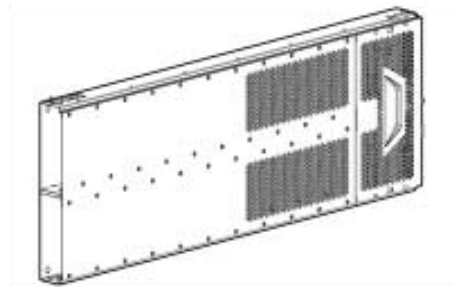
Figure 1. ProLiant BL p-Class server blade enclosure



Blade enclosure network signal routing

Each server bay supports up to six Ethernet signals (two iLO signals and four general-purpose signals) for a total of up to 48 NIC signals per enclosure. This is sufficient for ProLiant BL20p and BL30p servers, and it is ample for ProLiant BL40p servers, which have six NICs spread over four server bays. The ProLiant BL30p server blades are only half the height of a server blade bay. Two ProLiant BL30p servers fit in a ProLiant BL30p sleeve that slides into a single server bay (Figure 2). This results in a total of two iLO and four general-purpose NICs for the single server bay.

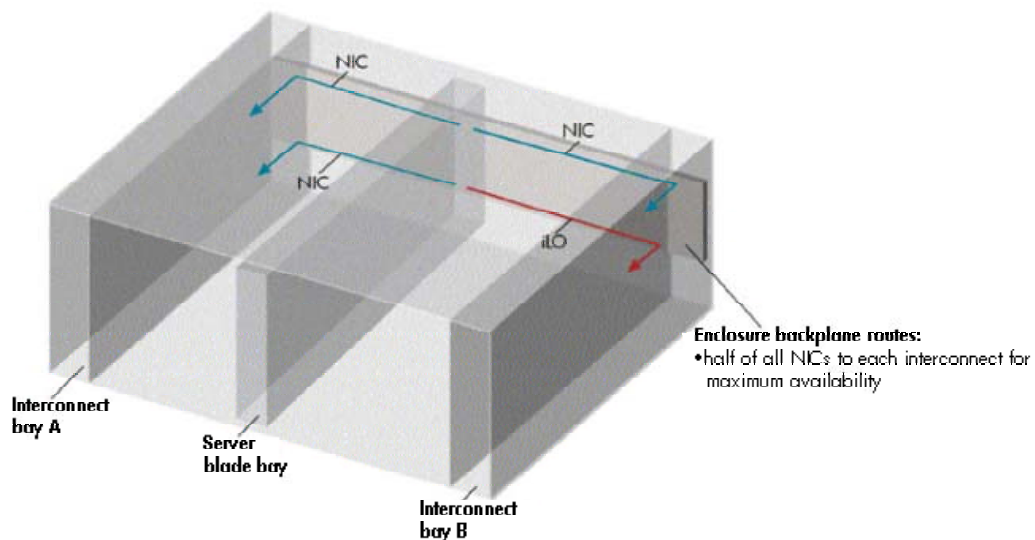
Figure 2. ProLiant BL30p server blade sleeve



Non-dedicated iLO server blade enclosure

The server blade enclosure without dedicated iLO has a signal backplane that routes all NIC signals (NC series data and iLO management) from the servers to the interconnect bays while completely isolating these signals from each other (Figure 3). Individual category 5e specified signal traces on the passive backplane route the network signals as Ethernet from the server blade NICs to the interconnect bays. To provide redundant network connections and to maximize network availability, half of the network signals from each server go to each interconnect bay, regardless of the server slot height (half height or full height), the server slot width (1 or 4 bay), or the number of NICs each server supports.

Figure 3. NIC signal routing in non-dedicated iLO server blade enclosure

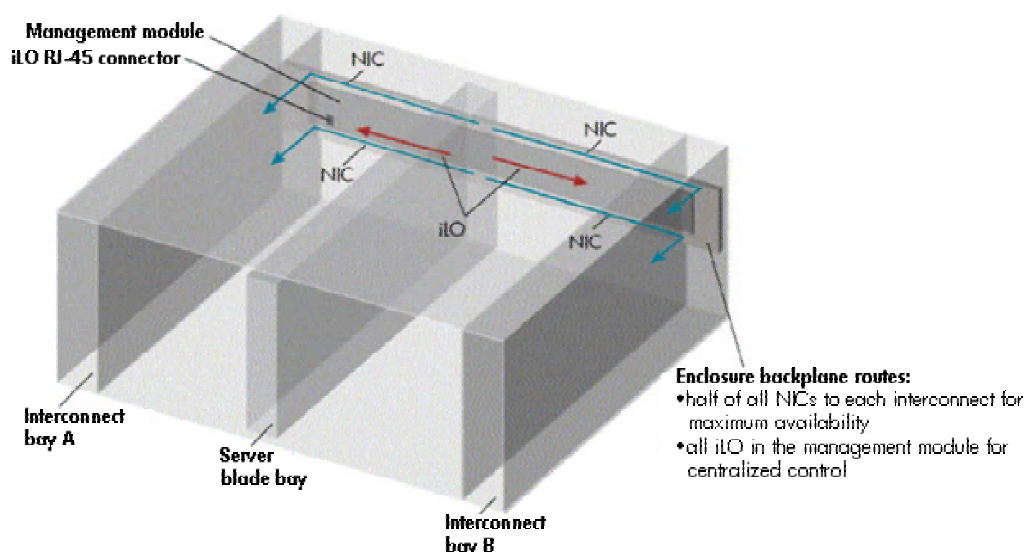


Dedicated iLO server blade enclosure

The server blade enclosure with dedicated iLO has a signal backplane that routes only the NC series NIC signals from the servers to the interconnect bays (Figure 4). As with the non-dedicated iLO enclosure, individual category 5e specified signal traces on the passive backplane route the network signals as Ethernet; half of the network signals from each server go to each interconnect bay.

The enclosure with dedicated iLO also routes the iLO Ethernet signals across individual category 5e specified signal traces, but to the server blade management module (see Figure 4). Located at the rear of each server blade enclosure, this hot-pluggable module provides a centralized 10/100T port with RJ-45 connector for all server blade iLO connections.

Figure 4. Ethernet signal routing in dedicated iLO server blade enclosure



The difference in iLO signal routing allows each enclosure to fulfill a specific set of iLO management needs. The dedicated iLO server blade enclosure is ideal for users who desire a simplified, centralized management point. The single 10/100T port can be included in a network management VLAN for management of all server blades. The non-dedicated iLO enclosure is an ideal solution for applications that require iLO management to reside in different VLANs or sub-nets.

Table 2 provides a summary of the ProLiant BL p-Class server NIC signal routing for each type of server blade enclosure.

Table 2. Summary of Ethernet signal routing for ProLiant BL p-Class server blade enclosure

	Interconnect bay A (left)	Interconnect bay B (right)	Management module
Non-dedicated iLO server blade enclosure			
ProLiant BL20p G2	2x NC7781	1x NC7781, 1x iLO	N/A
ProLiant BL30p	Not supported		
ProLiant BL40p	3x NC7781	2x NC7781, 1x iLO	N/A
Dedicated iLO server blade enclosure			
ProLiant BL20p G2	2x NC7781	1x NC7781	1x iLO
ProLiant BL30p	1x NC7781	1x NC7781	1x iLO
ProLiant BL40p	3x NC7781	2x NC7781	1x iLO

PXE

Each NC series NIC on the ProLiant BL servers supports PXE; one NIC at a time may be PXE enabled. A specific NIC on each server is preselected as the default PXE NIC. Therefore, all the PXE enabled NICs are initially routed to the same interconnect. To enhance system availability, the ROM Based Setup Utility (RBSU) for ProLiant BL servers can be used to configure PXE-enabled NICs that are routed to different interconnects.

ProLiant BL p-Class interconnects

HP offers six ProLiant BL p-Class interconnect options that allow customers to choose how Ethernet and Fibre Channel signals exit the server blade enclosure. These interconnect options include two ProLiant RJ-45 patch panel kits and four ProLiant interconnect switch kits. The two patch panel kits provide pass-through of network signals (RJ-45 Patch Panel Kit) or network and storage signals (RJ-45 Patch Panel 2 Kit), thus giving customers the flexibility to choose the network components they prefer. Alternatively, the four interconnect switch kits provide different levels of Ethernet switching functionality and Fibre Channel signal pass-through. Both server blade enclosures support all interconnect options.

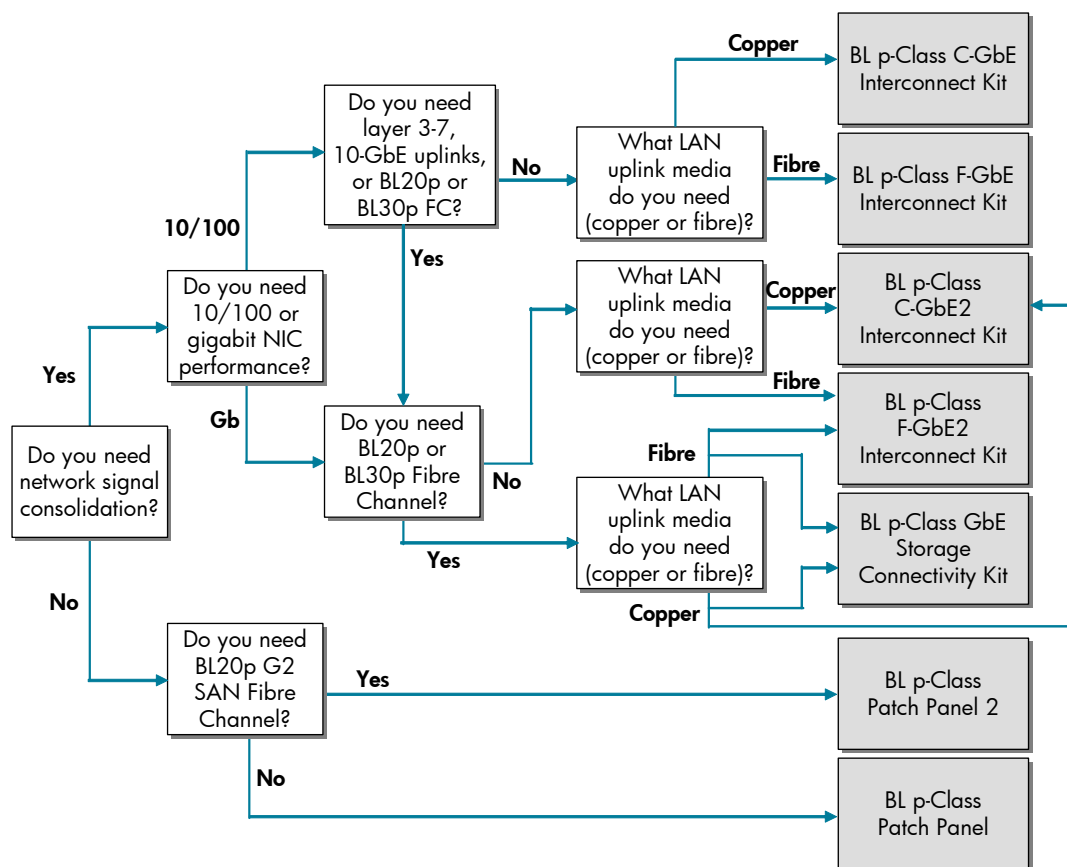
In general, customers should choose the appropriate interconnect option based on the following criteria:

- The first-generation RJ-45 Patch Panel Kit provides non-blocking Ethernet signal pass-through.
- The second-generation RJ-45 Patch Panel 2 Kit provides the same Ethernet signal pass-through as the first-generation kit, plus it adds Fibre Channel signal pass-through for ProLiant BL20p and BL30p servers.⁵
- The first-generation C-GbE and F-GbE Interconnect Kits provide non-blocking consolidation of 100 Mb/s Fast Ethernet NIC signals for copper and fiber-based networks, respectively.
- The second-generation C-GbE2 and F-GbE2 Interconnect Kits provide consolidation of 1000 Mb/s Gigabit Ethernet NIC signals, advanced network capabilities, future planned option upgradeability, and optional Fibre Channel storage signal pass-through for ProLiant BL20p and BL30p servers⁵.

⁵ Fibre Channel pass-through on the BL20p series servers is supported beginning with the BL20p G2.

Figure 5 contains an interconnect decision chart to assist customers in choosing an interconnect kit.

Figure 5. Interconnect decision chart



Each interconnect kit includes two interconnects for one server blade enclosure. Each interconnect itself consists of two hot-pluggable components, a front-loading interconnect blade and a rear-mounted interconnect module that contains the network connectors. This modular design provides two key benefits:

- The interconnect blade can be quickly and easily removed and replaced from the front of the rack without the need for recabling.
- The interconnect switches support copper or fiber Ethernet uplinks by using different interconnect modules. This design also allows the uplinks to be upgraded easily to future technology.

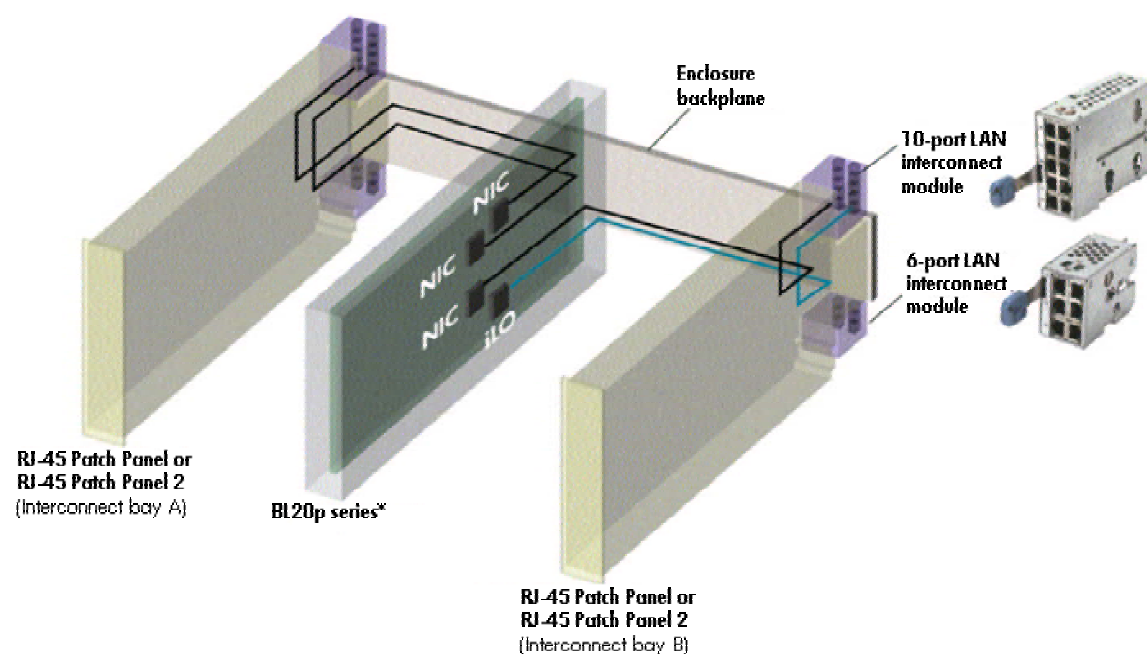
RJ-45 Patch Panel and RJ-45 Patch Panel 2 kits

The patch panel interconnects offer three significant benefits: they allow the customer to connect signals to their own LAN and SAN infrastructure components; they are very economical; and they are completely passive and require no software or management.

The RJ-45 Patch Panel and RJ-45 Patch Panel 2 kits each contain two patch panel interconnect blades that carry up to 32 Ethernet signals out as separate RJ-45 connections through two rear-mounted LAN interconnect modules per patch panel device. Both kits support ProLiant BL20p server blades (shown in Figure 6), ProLiant BL30p server blades, ProLiant BL40p server blades, or a combination of these server blades.

In addition to Ethernet signal pass-through, the RJ-45 Patch Panel 2 Kit provides front panel Fibre Channel storage ports to support signal pass-through for up to 8 ProLiant BL20p server blades or 16 ProLiant BL30p server blades, each with 2 Fibre Channel ports. The ProLiant BL40p server blade does not require routing Fibre Channel signals to the interconnect bays⁶.

Figure 6. RJ-45 Patch Panel and RJ-45 Patch Panel 2 pass-through Ethernet signal routing (shown with the non-dedicated iLO enclosure and ProLiant BL20p server blade)

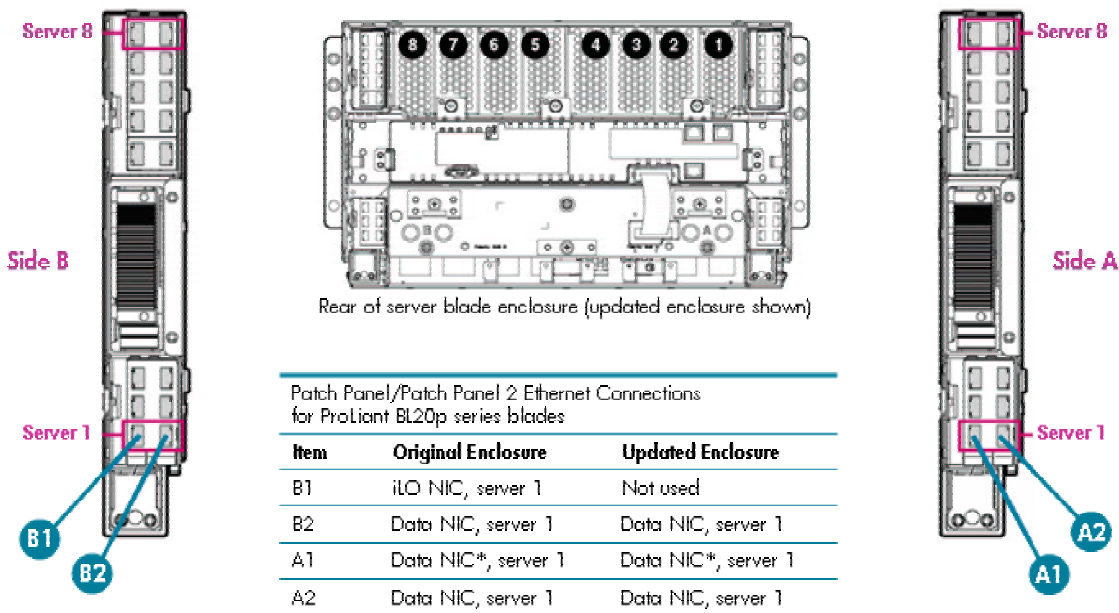


* ProLiant BL30p and BL40p server blades are also supported.

⁶ For information on the Fibre Channel signal routing and available options, see the *ProLiant BL p-Class SAN Storage Connectivity* white paper at http://h71025.www7.hp.com/support/reference_library/viewdocument.asp?countrycode=1000&prodid=57261ProLiant+BL+p-Class+System&source=TC030803TB.xml&dt=21&docid=20366.

Whether using the RJ-45 Patch Panel Kit or the RJ-45 Patch Panel 2 Kit, each RJ-45 connector corresponds to a specific Ethernet NIC in each server blade. For example, a ProLiant BL20p server blade installed in the server bay 1 (server 1) occupies the bottom row of connectors (Figure 7). Each consecutive server blade occupies the next highest row of connectors through server 8.

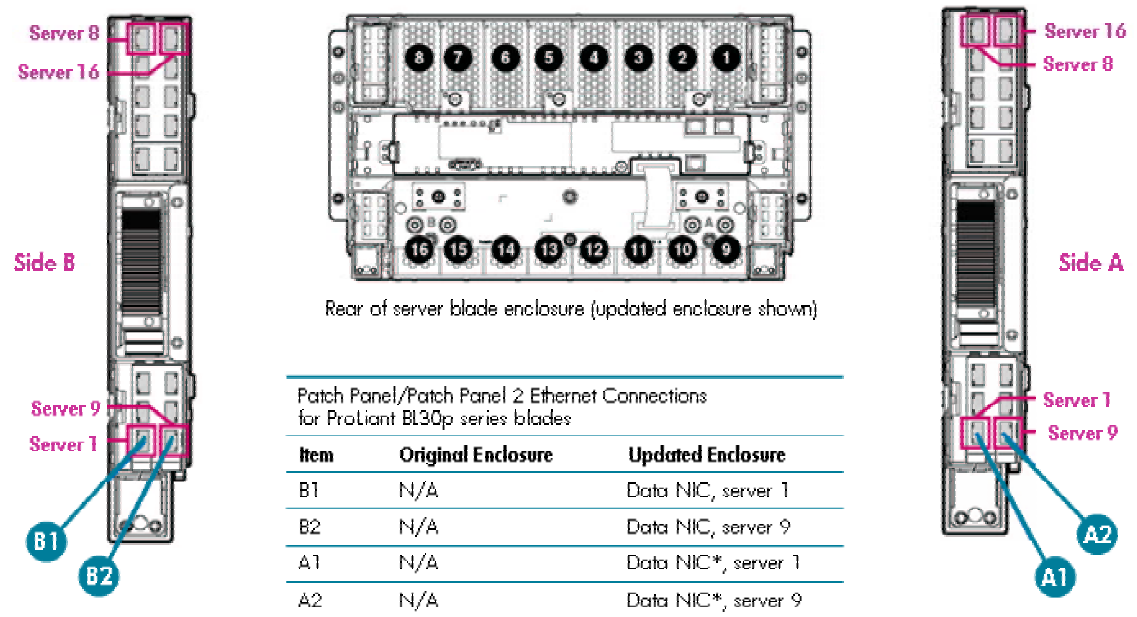
Figure 7. RJ-45 Patch Panel Kit and RJ-45 Patch Panel 2 Kit network connections for ProLiant BL20p server blades



* This is the default enabled PXE NIC. Using the RBSU on the server, any other data NIC may be PXE enabled.

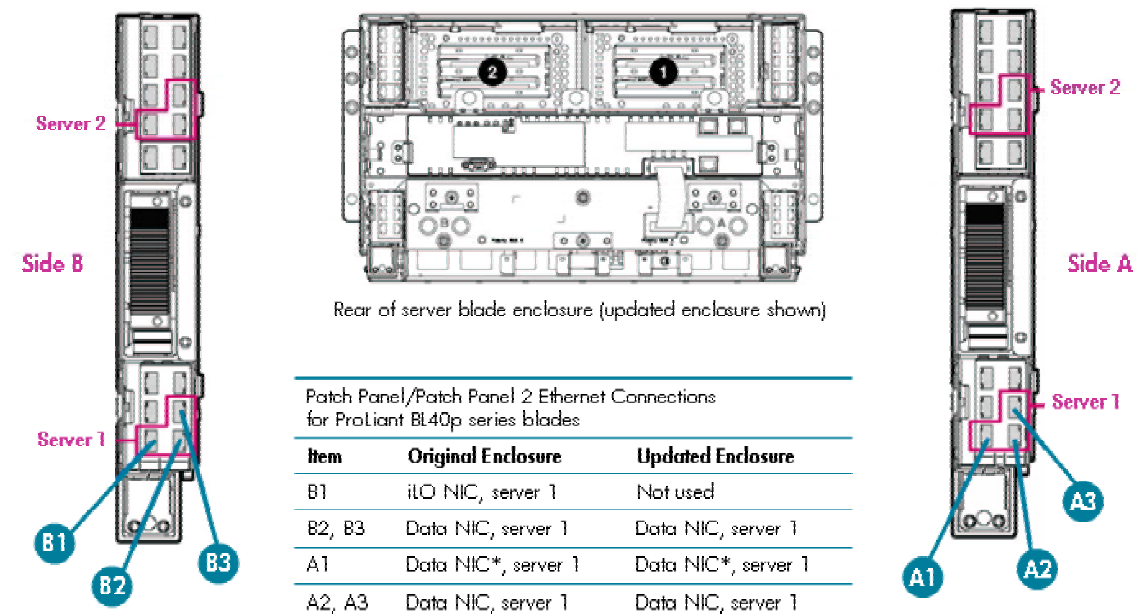
Figure 8 and Figure 9 show the RJ-45 Patch Panel Kit and the RJ-45 Patch Panel 2 Kit network connections for an enclosure full of 16 ProLiant BL30p servers and an enclosure full with 2 ProLiant BL40p servers, respectively.

Figure 8. RJ-45 Patch Panel Kit and RJ-45 Patch Panel 2 Kit network connections for ProLiant BL30p server blades



* This is the default enabled PXE NIC. Using the RBSU on the server, any other data NIC may be PXE enabled.

Figure 9. RJ-45 Patch Panel Kit and RJ-45 Patch Panel 2 Kit network connections for ProLiant BL40p server blades



* This is the default enabled PXE NIC. Using the RBSU on the server, any other data NIC may be PXE enabled.

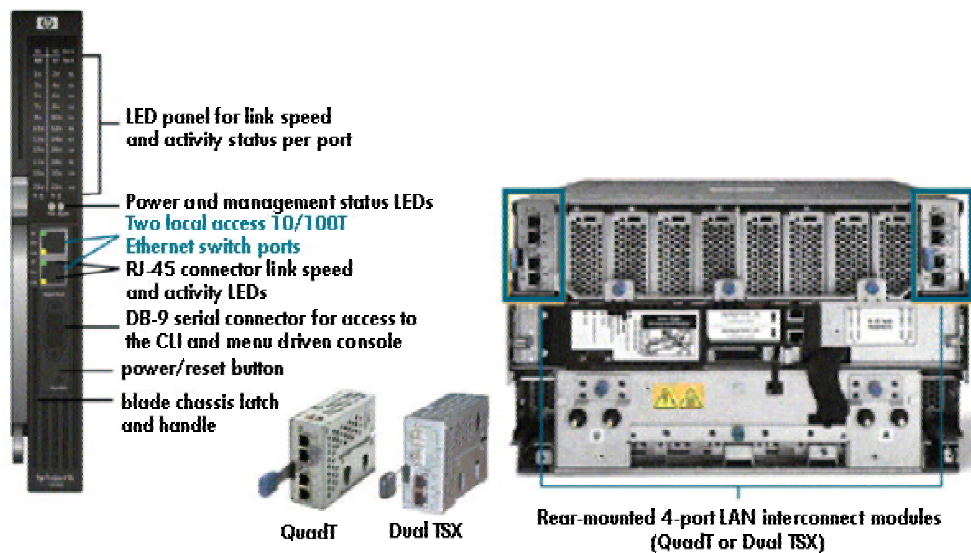
ProLiant GbE Interconnect Kit

For applications that require network cable reduction, the ProLiant GbE Interconnect Kit consolidates the server NIC signals to 100 Mb/s (Fast Ethernet) using two industry-standard Ethernet switches mounted into the server blade enclosure. The GbE Interconnect Kit includes two hot-swappable, fully managed Layer 2 Ethernet switches and two rear-mounted, 4-port LAN interconnect modules (Figure 10). The GbE Interconnect Kit is available in two options: the C-GbE Interconnect Kit for copper-based networks and the F-GbE Interconnect Kit for fiber-based networks.

The difference between the kits is the LAN interconnect module that supports the uplink port media. The C-GbE Interconnect kit includes two QuadT interconnect modules, each with two 10/100/1000T and two 10/100T ports; all with RJ-45 connectors. The F-GbE Interconnect Kit includes two DualTSX interconnect modules, each with two 1000SX ports with LC connectors and two 10/100T ports with RJ-45 connectors.

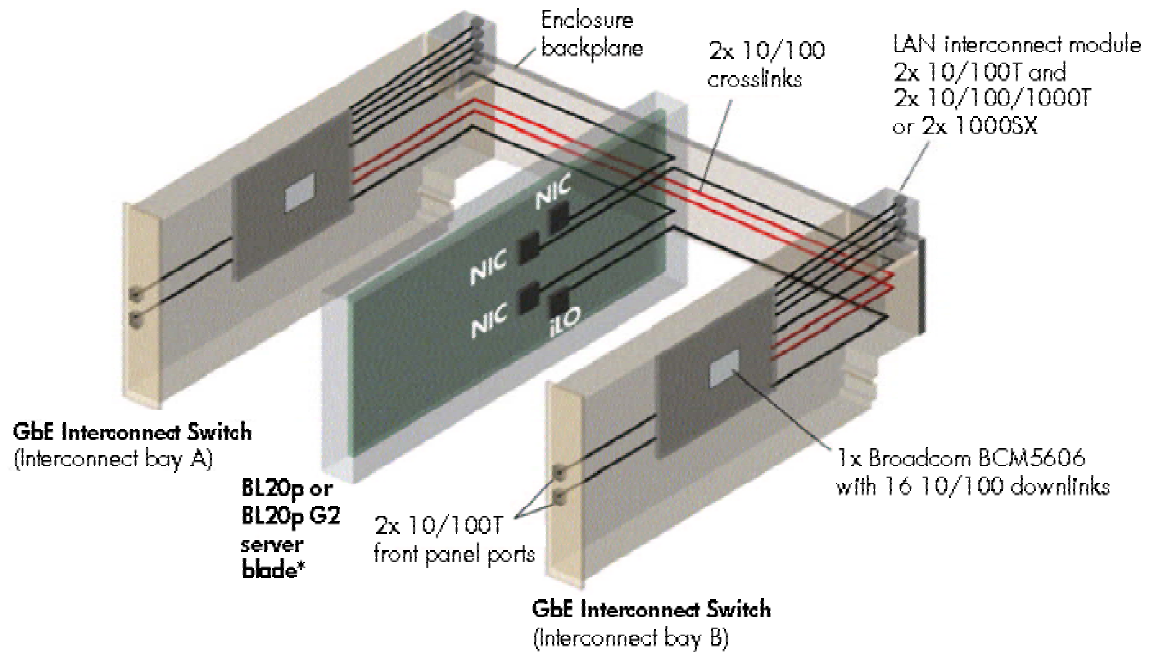
Each GbE Interconnect Switch reduces up to 16 internal server blade NIC ports to 6 external Ethernet ports, 4 ports on the rear-mounted LAN interconnect module and 2 ports on the switch front panel. The front panel ports are for local switch access, port mirroring and other diagnostics, or additional uplinks to the network. Because each external Ethernet port can communicate to all the server blades, from 1 to 12 external ports (per enclosure) may be used to connect to the network infrastructure.

Figure 10. ProLiant BL p-Class GbE Interconnect Switch, front panel and rear view



The two GbE Interconnect Switches are connected across the server blade enclosure backplane through a pair of redundant 10/100 Ethernet crosslinks bundled into a multiport EtherChannel compatible trunk (see **Figure 11**). These crosslinks permit communication between the switches for additional management capability, fault tolerance, and cable reduction. As a result, any single uplink port may be used to connect to a maximum of 32 NICs for a 32-to-1 network cable reduction.

Figure 11. ProLiant BL p-Class GbE Interconnect Kit architecture (shown with the dedicated iLO enclosure and ProLiant BL30p server blade)



* The ProLiant BL40p server blades are also supported.

The redundant architecture of the GbE Interconnect Kit allows system administrators to configure the Ethernet network for continued access to each server blade in case of the following failures:

- Interconnect switch failure
- Switch failure within the Ethernet network backbone
- Server blade network adapter failure
- Server blade NIC-to-interconnect switch port failure or connection failure
- Uplink port and uplink port connection or cable failure
- Interconnect switch crosslink port or connection failure
- Power or fan failure

For more information, see the *ProLiant BL p-Class GbE Interconnect Kit Overview* white paper.⁷

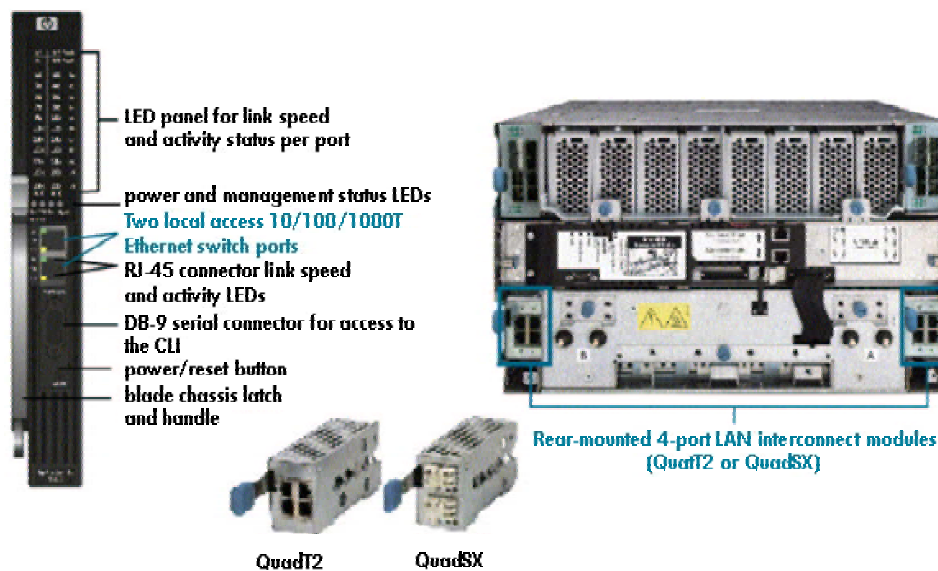
⁷ Available at http://www.procompaq.com/support/reference_library/viewdocument.asp?source=5982-2729EN.xml&dt=21.

ProLiant GbE2 Interconnect Kit

The second-generation ProLiant GbE2 Interconnect Kit is also designed to significantly reduce the number of Ethernet network cables attached to the rear of the server blade enclosure. However, it is designed for applications that require network adapter consolidation to 1000 Mb/s (Gigabit Ethernet), advanced network functionality, future upgradeability including Layer 3-7 switching and 10-Gigabit Ethernet uplink bandwidth, and Fibre Channel storage signal pass-through.

The GbE2 Interconnect Kit contains two hot-swappable, fully managed Layer 2 GbE2 Interconnect Switches and two LAN interconnect modules (Figure 12). The GbE2 Interconnect Kit is available in two versions: C-GbE2 for copper-based networks and F-GbE2 for fiber-based networks. These interconnect kits are identical except for their interconnect modules. The C-GbE2 Interconnect Kit includes two QuadT2 interconnect modules, each with four 10/100/1000T ports with RJ-45 connectors. The F-GbE2 Interconnect Kit includes two QuadSX interconnect modules, each with four 1000SX ports with LC connectors.

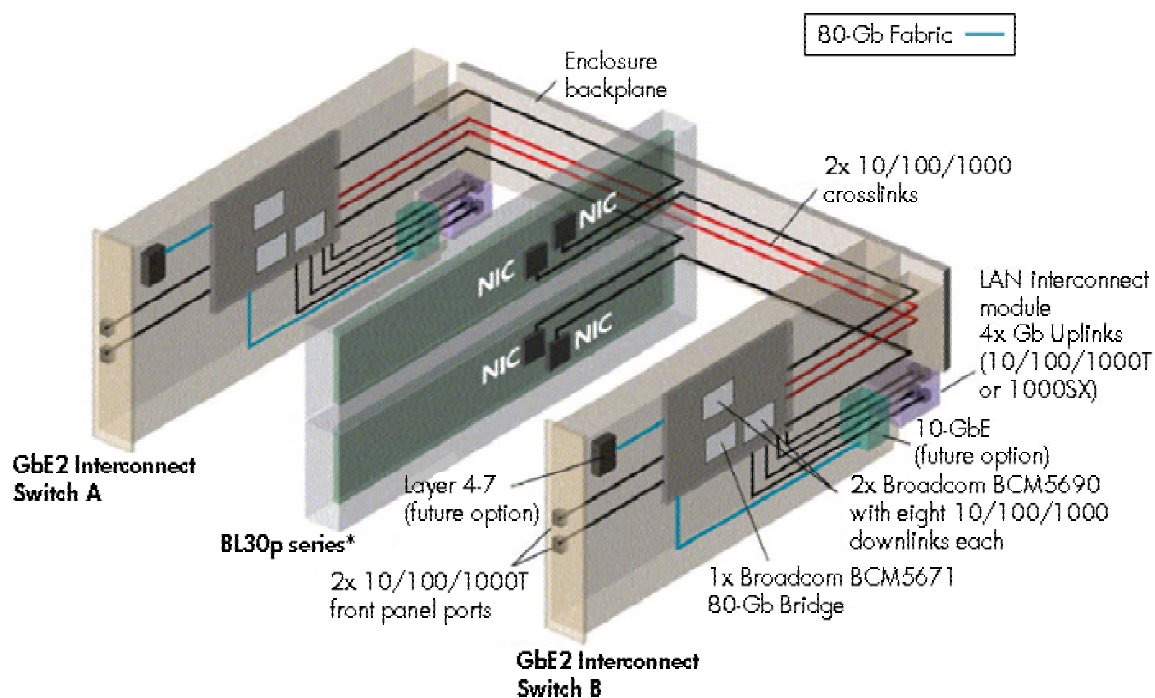
Figure 12. ProLiant BL p-Class GbE2 Interconnect Switch, front panel and rear view



In addition to providing up to a 32-to-1 server networking cable reduction per server enclosure, the GbE2 Interconnect Kit offers the following:

- All switch ports provide Gigabit Ethernet performance to support applications that require network adapter consolidation to 1000 Mb/s. Each GbE2 Kit provides 24 Gb/s full duplex external port (uplink) bandwidth per server blade enclosure.
- A future upgrade is planned to provide Layer 3 support with only a firmware upgrade.
- A non-blocking 80-Gb/s fabric is standard on each GbE2 Interconnect Switch. The fabric supports future planned Layer 4-7 IP load balancing and 10-Gigabit Ethernet uplink options (Figure 13) and is offered through HP's partner Nortel Networks. The switching layer and the uplink bandwidth can be independently selected within a single switch offering.
- Advanced network feature support and system availability is provided, including interoperability with Cisco's PVST+, 9k jumbo frames, RADIUS, redundant syslog servers, redundant operating system firmware images and configuration files in memory, and more.
- Optional pass-through of ProLiant BL20p and BL30p series Fibre Channel storage signals is available using the GbE2 Storage Connectivity Kit. As a result, both Ethernet signal consolidation and Fibre Channel pass-through are now possible using a single interconnect. For more information, see the *ProLiant BL p-Class SAN Connectivity* technology brief⁸.

Figure 13. ProLiant BL p-Class GbE2 Interconnect Kit architecture (shown with the dedicated iLO enclosure and ProLiant BL30p server blade)



* The ProLiant BL20p and BL40p server blades are also supported.

For more information, see the *ProLiant BL p-Class GbE2 Interconnect Switch Overview* white paper⁹.

⁸ Available at http://h71025.www7.hp.com/support/reference_library/viewdocument.asp?countrycode=1000&prodid=5726|ProLiant+BL+p-Class+System&source=TC030803TB.xml&dt=21&docid=20366.

⁹ Available at http://wws1pro.compaq.com/support/reference_library/viewdocument.asp?source=5982-2175EN.xml&dt=21.

Investment protection and interconnect flexibility

The ProLiant BL p-Class interconnects are designed to support past, present, and future ProLiant BL p-Class servers. The BL p-Class server blade enclosures support many different combinations of ProLiant BL20p, BL30p, and BL40p series servers and interconnect options. All ProLiant BL p-Class interconnects support both types of ProLiant BL p-Class server blade enclosures.

As needs and applications change, an interconnect option may be changed from a first-generation patch panel or interconnect switch kits to a second-generation kit. Likewise, any patch panel kit may be replaced with any interconnect switch kit (or *vice versa*). Even copper-based C-GbE and C-GbE2 interconnect switch kits may be converted to fiber-based F-GbE and F-GbE2 kits (or *vice versa*), by replacing the interconnect modules that contain the uplink ports.

Conclusion

The networking design of the ProLiant BL p-Class provides maximum flexibility and significant performance in an end-to-end redundant architecture. The network adapters included as standard with each server are routed to a pair of fully redundant, hot-swappable interconnects. HP offers a wide selection of interconnect kits for a choice of Ethernet cable consolidation and Fibre Channel signal pass-through. The economical patch panel kits allow network administrators to use the network switch or other components of their choice. The interconnect switches are ideal for reducing Ethernet network cabling and the time required to deploy, manage, and service ProLiant BL p-Class systems.

For more information

For additional information, refer to the resources detailed below.

Resource description	Web address
ProLiant BL system home page	http://h18004.www1.hp.com/products/servers/platforms/index-bl.html
ProLiant NC series network adapter home page	http://h18004.www1.hp.com/products/servers/networking/index.html
<i>ProLiant BL p-Class GbE2 Interconnect Switch Overview</i> white paper	http://wws1pro.compaq.com/support/reference_library/viewdocument.asp?source=5982-2175EN.xml&dt=21
<i>ProLiant BL p-Class GbE Interconnect Switch Overview</i> white paper	http://wws1pro.compaq.com/support/reference_library/viewdocument.asp?source=5982-2729EN.xml&dt=21
<i>ProLiant BL p-Class SAN storage connectivity technology brief</i>	http://h71025.www7.hp.com/support/reference_library/viewdocument.asp?countrycode=1000&prodid=5726 ProLiant+BL+p-Class+System&source=TC030803TB.xml&dt=21&docid=20366
<i>ProLiant BL p-Class GbE and GbE2 Interconnect Switch</i> user guides	http://welcome.hp.com/country/us/en/support.html

Call to action

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